UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant:	Yuriy Gmirya	Group Art Unit:	3681
Serial No.:	10/621,129	Examiner:	Le, David D.
Filed:	July 16, 2003		
Title:	**SPLIT-TORQUE GEAR BOX**		

Commissioner for Patents
Mail Stop Appeal Brief-Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

Appellant submits this Appeal Brief pursuant to the Notice of Appeal filed 6-26-2007.

I. REAL PARTY IN INTEREST

The real party in interest is **Sikorsky Aircraft Corporation**, assignee of the present invention.

II. RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, interferences or judicial proceedings which may directly affect or may be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1, 3, 7-24, 26, 27, and 38-45are pending, rejected and herein appealed.

Claims 2 and 25 have been canceled.

Claims 28-38 stand withdrawn.

IV. STATUS OF AMENDMENTS

All amendments have been entered. Appellant appreciates that the 35 USC 112 rejections have been overcome in the 3 April 2007 request for reconsideration.

V. SUMMARY OF CLAIMED SUBJECT MATTER

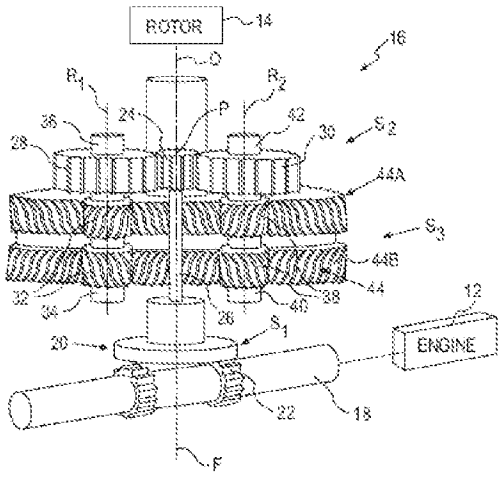


FIG. 2

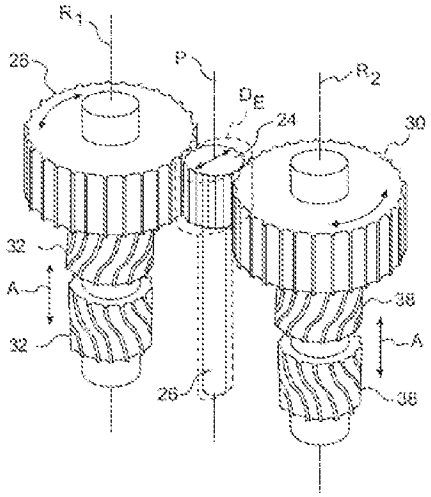


FIG. 3

Summary of Claim 1

Referring in particular to Figures 2 and 3, claim 1 is directed to a split torque gearbox system 10. The system includes a floating pinion gear 24 driven by a radially unsupported pinion shaft 26, the floating pinion gear 24 mounted for rotation about a floating pinion axis of rotation P which provides a resilient characteristic. [Page 4, lines 25-30.] The floating pinion gear 24 axis of rotation P displaceable to split a load between the first spur gear 28 and the second spur gear 30, the floating pinion axis of rotation P, the first spur gear 28 axis of rotation

R1, and the second spur gear 30 axis of rotation R2 located along a common line L (see Figure 4). [Page 5, lines 1-5.] The radially unsupported pinion shaft 26 is driven through a gear mesh generally transverse to the floating pinion axis of rotation P such that the radially unsupported pinion shaft 26 is displaceable off the common line L (see Figure 4) to split the load between the first spur gear 28 and the second spur gear 30.

Summary of Claim 8

Referring in particular to Figure 2 and 3, claim 8 is directed to a split torque gearbox system 10 for a rotary wing aircraft. A face gear 20 is driven by an input shaft 18 about a face gear 20 axis of rotation F. A floating pinion gear 24 is driven by a radially unsupported pinion shaft 26 mounted to the face gear 20, the floating pinion gear 24 mounted for rotation about a floating pinion axis of rotation P which provides a resilient characteristic. The floating pinion axis of rotation P, the first spur gear 28 axis of rotation R1, and the second spur gear 30 axis of rotation R2 located along a common line L (see Figure 4). [Page 5, lines 1-5.] The floating pinion axis of rotation P displaceable off the common line L (see Figure 4) to split a load between the first spur gear 28 and the second spur gear 30. [Page 5, lines 5-9.] A first double helical gear 32 driven by the first spur gear 28, the first double helical gear 32 defined along the first spur gear 28 axis of rotation R1. [Page 5, lines 10-15.] A second double helical gear 38 driven by the second spur gear 30, the second double helical gear 38 defined along the second spur gear 30 axis of rotation R2 and an output gear 44 meshed with the first and second double helical gears 32, 38. [Page 5, lines 14-26.]

Summary of Claim 12

Referring in particular to Figures 2 and 3, claim 12 is directed to a method of splitting torque within a split torque gearbox system 10 includes: driving a floating pinion gear 24 about a pinion gear axis of rotation P through a radially unsupported pinion shaft 26 which provides a resilient characteristic, the radially unsupported pinion shaft 26 driven through a gear mesh generally transverse to the pinion gear axis P [Page 4, lines 25-30]; and engaging the floating pinion gear 24 with a first gear 28 and a second gear 30, the first gear 28 rotating around a first gear axis of rotation R1, the second gear 30 rotating around a second gear axis of rotation R2, the

first gear axis of rotation R1, the second gear axis of rotation R2 and the pinion gear axis of rotation P located along a common line L (see Figure 4), the pinion gear axis of rotation P displaceable off the common line L (see Figure 4) to split a load between the first gear 28 and the second gear 30. [Page 5, lines 1-9.]

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1, 3, 4, 12, 16-24, 38, and 41-44 were rejected under 35 U.S.C. §102(b) as being anticipated by *White* (4489625).

Claims 5-11, 13-15, 26, 27, 39, and 40 were rejected under 35 U.S.C. §103(a) as being unpatentable over *White* in view of *Kish* (5813292).

VII. ARGUMENT

§102(b) REJECTIONS

Claims 1, 3, 4, 12, 16-24, 38, and 41-44

Claims 1, 3, 4, 12, 16-24, 38, and 41-44 were rejected under 35 U.S.C. §102(b) as being anticipated by *White* (4489625).

Appellant respectfully traverses this rejection. The Examiner argues that *White* discloses:

> - A floating pinion gear (i.e., Fig. 8, element 116) driven by a radially unsupported pinion shaft mounted to the face gear, the floating pinion gear meshed with the first spur gear and the second spur gear, and the floating pinion gear mounted for rotation about a floating pinion axis of rotation which provides a resilient characteristic (i.e., Fig. 8; column 11, lines 26-43);
>
> [8/18/2006 Office Action, page 4]

The Examiner fails to identify a radially unsupported pinion shaft that is disclosed or suggested by *White*. In fact, the Examiner specifically avoids applying a reference numeral to the purported *radially unsupported pinion shaft*. The Examiner specifically refers to element 116 as a floating

pinion gear. *White* states that "the drive pinion 116 [is allowed] to float freely between the two driven gears 117, its driving position set by the balance of two diametrically opposed mesh forces."

> The embodiment of FIG. 7 illustrates how the inclination of the cross shafts **106** and **107** can be adjusted by alternate positions of the drive pinions **116** driven by the second stage reduction bevel gears **115**. In the lower half of FIG. 7, each of the two second stage reduction bevel gears **115** and attached pinions **116** is on a line joining the axes of the corresponding adjacent final drive pinions **108**. When the axis of the drive pinion **116** is collinear with the axes of the two dual drive gears **117** it powers, equal load-sharing between the two meshes and, consequently, the two associated final drive pinions **108** can be effected by allowing the drive pinion **116** to float freely between the two driven gears **117**, its driving position set by the balance of two diametrically opposed mesh forces. Therefore, the dual drive ar-

[*White*, Col. 11, lines 23-37.]

Regardless, *White* completely fails to disclose or suggest that the drive pinion 116 is driven by a radially unsupported pinion shaft. The only apparently related side view of the Figure 7 embodiment is that of *White* Figure 8.

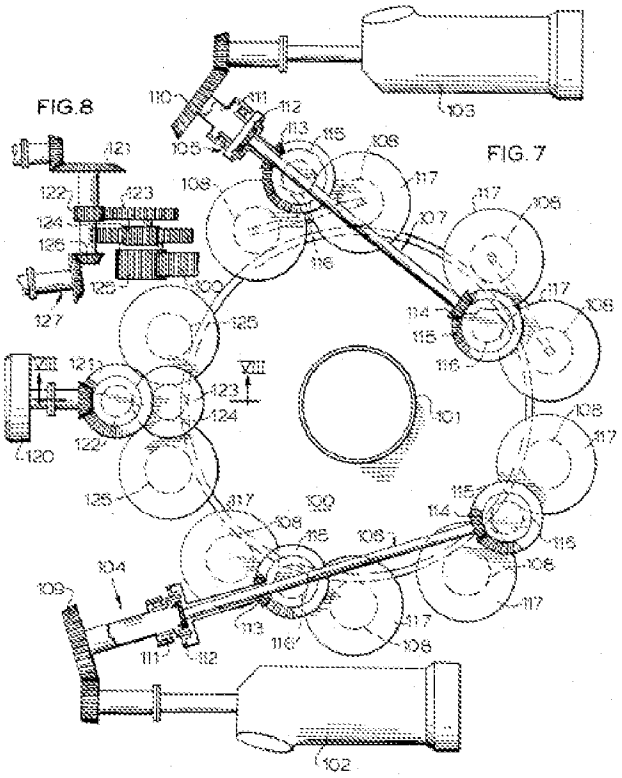


Figure 8 illustrates a tail rotor take off shaft 127 from a third engine 120 in a side view which appears to be from the top view of drive pinion 116 in Figure 7. ***Neither figure 7 nor 8 discloses or***

suggests a radially unsupported pinion shaft driving a floating pinion gear and displaceable off a common line to split load between first and second spur gears.

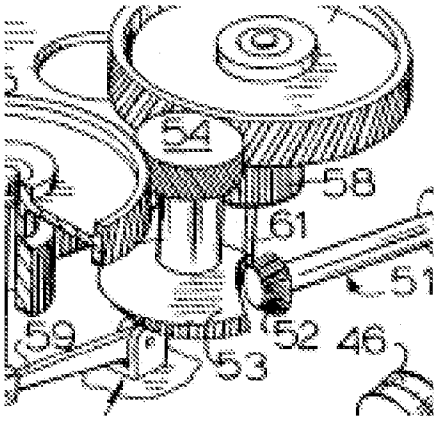
Furthermore, nowhere within *White* is a radially unsupported pinion shaft disclosed or suggested by drive pinion 116 or what appears to be equivalent drive pinion 124. Appellant respectfully suggests that *White* fails to disclose or suggest at least the subject matter of a radially unsupported pinion shaft, said floating pinion gear mounted for rotation about a floating pinion axis of rotation which provides a resilient characteristic as recited in Appellant's claims 1, 8, and 12. Since *White* fails to disclose or suggest at least this particular subject matter, the rejection is thereby defeated. The claims are properly allowable over *White*.

In the Response to Argument section of the 02-06-2007 Office action, the Examiner argues that Figure 5 of *White* discloses a pinion 54 which is similar to the drive pinion 116 and is mounted to a radially unsupported pinion shaft.

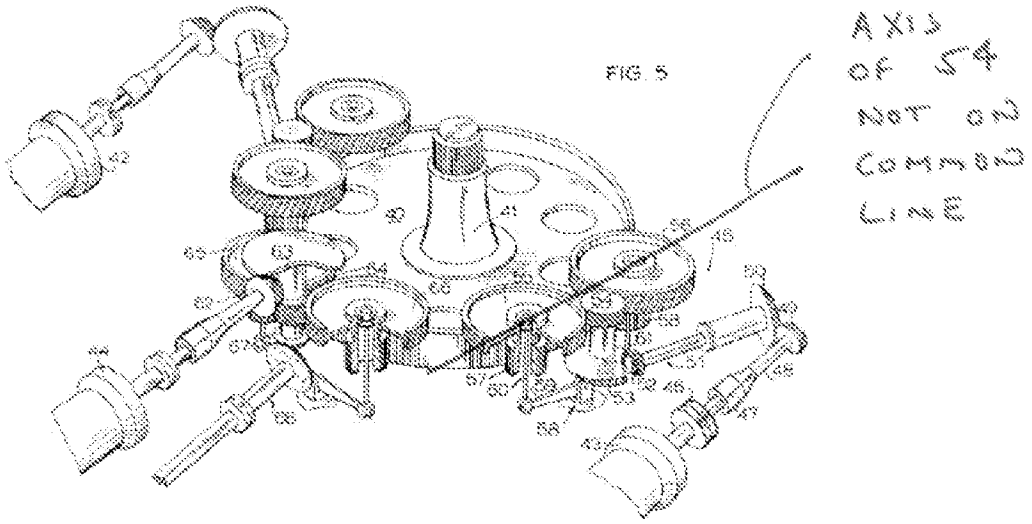
> Examiner respectfully disagrees because, Fig. 5 of White'625 reference discloses a drive pinion 54, which is similar to the drive pinion 116, is mounted to a radially unsupported pinion shaft; and therefore, White'625 reference does suggest that the drive pinion 116 is mounted to a radially unsupported pinion shaft.

Irrespective of whether pinion 54 is mounted to a "radially unsupported pinion shaft," the gear arrangement of *White* inherently prevents the shaft of drive pinion 54 from being displaceable off said common line to split said load between said first spur gear and said second spur gear as recited in Appellant's claims for at least the following reasons:

Firstly, *White* Figure 5 itself illustrates a stout large diameter shaft for pinion 54 which is not radially displaceable based on the structure alone (see expanded portion of Figure 5 below).



Secondly, pinion 54 is not located along a common line drawn between the axes of rotation of gears 55 and 56 (see annotated Figure 5 below). That is, the axis of rotation of drive pinion 54 is not along a common line as illustrated in the following annotation.



Thirdly, since the drive pinion 54 is not located along a common line with gears 55, 56 any displacement of drive pinion 54 would result in disengagement with one of gears 55, 56 rendering the gear train inoperable.

Even if only one of these arguments is upheld, the entire Rejection fails. The Claims are therefore properly allowable.

§103(a) REJECTIONS

Claims 5-11, 13-15, 26, 27, 39, and 40 were rejected under 35 U.S.C. §103(a) as being unpatentable over *White* in view of *Kish* (5813292).

Claims 5-11, 13-15, 26, 27, 39, and 40

A. THE COMBINATION OF *WHITE* IN VIEW OF *KISH* IS IMPROPER FOR AT LEAST THE FOLLOWING REASONS:

I. *Kish* fails to cure the admitted deficiency of *White*

The entire rejection must fail as there is absolutely no motivation to modify *White* in view of *Kish* as proposed. It is axiomatic that an obviousness rejection must come from the suggestions or teachings of the references themselves. A proper suggestion or motivation to make a combination requires some benefit to result from the combination. When the additional teachings of a secondary reference do not provide any benefit to the arrangement disclosed in a primary reference, no prima facie case of obviousness exists. Because this combination provides no benefit and is therefore improper, there is no prima facie case of obviousness.

As the Examiner admits, *Kish* does not teach a floating pinion gear driven by radially unsupported pinion shaft which provides a resilient characteristic to allow the floating pinion axis of rotation to be displaceable off the common curve line to split a load between the first spur gear and the second spur gear.

> *Kish* does not explicitly teach a floating pinion gear driven by a radially unsupported pinion shaft, which provides a resilient characteristic to allow the floating pinion axis of rotation to be displaceable off the common curved line to split a load between the first spur gear and the second spur gear.

[2-16-2006 Office Action; page 7] Whereas *White* fails to disclose a radially unsupported pinion shaft which provides a resilient characteristic as discussed above and the Examiner admits that *Kish* likewise fails to do so, *Kish* fails to cure the admitted deficiency of *White*.

B. DIFFERENCES BETWEEN THE CLAIMED INVENTION AND THE PROPOSED COMBINATION

Even if the proposed combination of *White* in view of *Kish* were properly made – which it is not - there are differences between the claimed invention and the teachings of the cited references so that the combination does not meet the subject matter of Appellant's claims.

INDEPENDENT CLAIMS

Claims 8 and 12

Notably, it appears that the Examiner is utilizing *Kish* only to teach the usage of first double helical gears and a relative size difference therebetween. Although *Kish* does teach helical gears, *Kish,* like *White* and as admitted by the Examiner as discussed above, fails to disclose or suggest any floating pinion gear mounted for rotation about a floating pinion axis of rotation which provides a resilient characteristic. The claims are properly allowable.

DEPENDANT CLAIMS

Claims 41 and 45

I. The Face Gear Feature

Claims 41-45 recite further features of the present invention which are neither disclosed nor suggested by the cited references and are thus properly allowable. Claim 41 recites:

> a first spur gear periphery of said first spur gear and a second spur gear periphery of said second spur gear at least partially overlaps an output gear periphery of said output gear adjacent a first side of said output gear, and a face gear periphery of said face gear at least partially overlaps said output gear periphery adjacent a second side of said output gear.

Claim 45 recites:

> a first spur gear periphery of said first spur gear and a second spur gear periphery of said second spur gear at least partially overlaps an output gear periphery of said output gear adjacent a first side of said output gear, and a face gear periphery of said face gear at least partially overlaps said output gear periphery adjacent a second side of said output gear.

Notably, *White* fails to disclose or suggest a face gear adjacent one side of the output gear 100 and a first and second spur gear adjacent an opposite side of the output gear 100 where the face gear and both spur gears define a periphery which overlap a periphery of the output gear 100. Appellant's novel gear arrangement beneficially provides a significantly more compact split torque gearbox system as further recited in these claims.

VIII. CONCLUSION

For the above reasons, the rejections by the Examiner should be reversed. The Commissioner is authorized to charge the $500 filing fee to Deposit Account No. 19-2189 and the $120 one month extension fee to Deposit Account No. 50-1482.

Respectfully Submitted,

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CLAIMS APPENDIX

1. A split torque gearbox system comprising:

a first spur gear mounted for rotation about a first spur gear axis of rotation;

a second spur gear mounted for rotation about a second spur gear axis of rotation; and

a floating pinion gear driven by a radially unsupported pinion shaft, said floating pinion gear mounted for rotation about a floating pinion axis of rotation which provides a resilient characteristic, said floating pinion gear meshed with said first spur gear and said second spur gear, said floating pinion gear axis of rotation displaceable to split a load between said first spur gear and said second spur gear, said floating pinion axis of rotation, said first spur gear axis of rotation, and said second spur gear axis of rotation located along a common line, said radially unsupported pinion shaft driven through a gear mesh generally transverse to the floating pinion axis of rotation such that said radially unsupported pinion shaft is displaceable off said common line to split said load between said first spur gear and said second spur gear.

3. The split torque gearbox system as recited in claim 1, further comprising a face gear mounted to said pinion shaft to define said gear mesh generally transverse to the floating pinion axis of rotation.

4. The split torque gearbox system as recited in claim 3, wherein said gear mesh includes a spiral bevel gear teeth arrangement

5. The split torque gearbox system as recited in claim 1, further comprising:

a first double helical gear driven by said first spur gear, said first double helical gear defined along said first spur gear axis of rotation; and

a second double helical gear driven by said second spur gear, said second double helical gear defined along said second spur gear axis of rotation.

6. The split torque gearbox system as recited in claim 5, further comprising an output gear meshed with said first and second double helical gear.

7. The split torque gearbox system as recited in claim 6, further comprising a main rotor shaft driven by said output gear.

8. A split torque gearbox system for a rotary wing aircraft comprising:

an input shaft;

a face gear driven by said input shaft about a face gear axis of rotation;

a first spur gear mounted for rotation about a first spur gear axis of rotation;

a second spur gear mounted for rotation about a second spur gear axis of rotation; and

a floating pinion gear driven by a radially unsupported pinion shaft mounted to said face gear, said floating pinion gear mounted for rotation about a floating pinion axis of rotation which provides a resilient characteristic said floating pinion gear meshed with said first spur gear and said second spur gear, said floating pinion axis of rotation, said first spur gear axis of rotation, and said second spur gear axis of rotation located along a common line, said floating pinion axis of rotation

displaceable off said common line to split a load between said first spur gear and said second spur gear;

a first double helical gear driven by said first spur gear, said first double helical gear defined along said first spur gear axis of rotation;

a second double helical gear driven by said second spur gear, said second double helical gear defined along said second spur gear axis of rotation; and

an output gear meshed with said first and second double helical gears.

9. The split torque gearbox system as recited in claim 8, further comprising a main rotor shaft driven by said output gear.

10. The split torque gearbox system as recited in claim 8, wherein said input shaft is driven by a gas turbine engine.

11. The split torque gearbox system as recited in claim 8, wherein said face gear defines a gear face perpendicular to said face gear axis of rotation, said input shaft angled relative said gear face.

12. A method of splitting torque within a split torque gearbox system comprising the steps of:

(1) driving a floating pinion gear about a pinion gear axis of rotation through a radially unsupported pinion shaft which provides a resilient characteristic, the radially unsupported pinion shaft driven through a gear mesh generally transverse to the pinion gear axis; and

(2) engaging the floating pinion with a first gear and a second gear, the first gear rotating around a first gear axis of rotation, the second gear rotating around a second gear axis of rotation, the first gear axis of rotation, the second gear axis of rotation and the pinion gear axis of rotation located along a common line, the pinion gear axis of rotation displaceable off the common line to split a load between the first gear and the second gear.

13. A method as recited in claim 12, further comprising the steps of:

driving a first double helical gear by the first gear, the first double helical gear rotating about the first gear axis of rotation and axially movable along the first gear axis of rotation; and

driving a second double helical gear by the second gear, the second double helical gear rotating about the second gear axis of rotation, and axially movable along the second gear axis of rotation.

14. A method as recited in claim 13, further comprising the steps of:

driving an output gear about an output gear axis of rotation with the first and second double helical gear.

15. A method as recited in claim 13, further comprising the steps of:

driving a rotor system about the output gear axis of rotation with the output gear.

16. A method as recited in claim 12, further comprising the steps of:

driving a face gear which defines the gear mesh generally transverse to the pinion gear axis about a face gear axis of rotation with a high speed input shaft;

driving the floating pinion with the face gear through a floating pinion shaft.

17. A method as recited in claim 16, further comprising the steps of:

driving the high speed input shaft along an input shaft axis of rotation which is angled relative the face gear.

18. A method as recited in claim 17, further comprising the steps of:

driving a second face gear about a second face gear axis of rotation, the second face gear axis of rotation parallel to the face gear axis of rotation.

19. A method as recited in claim 17, further comprising the steps of:

driving a second face gear about a second face gear axis of rotation, the second face gear axis of rotation defined along the face gear axis of rotation.

20. The split torque gearbox system as recited in claim 1, wherein said floating pinion gear is mounted to said radially unsupported pinion shaft in a cantilever manner.

21. The split torque gearbox system as recited in claim 20, wherein said floating pinion gear is mounted to a distal end of said radially unsupported pinion shaft.

22. The split torque gearbox system as recited in claim 1, wherein a displacement envelope within which said floating pinion gear axis of rotation may be displaced is non-linear.

23. The split torque gearbox system as recited in claim 1, wherein a displacement envelope within which said floating pinion gear axis of rotation may be displaced is transverse to said floating pinion gear axis of rotation.

24. The split torque gearbox system as recited in claim 1, wherein a displacement envelope within which said floating pinion gear axis of rotation may be displaced to split said load between said first spur gear and said second spur gear is generally diamond shape.

26. A method as recited in claim 13, further comprising the steps of:

mounting the floating pinion gear in a cantilever manner to a distal end of the radially unsupported pinion shaft to define a displacement envelope.

27. A method as recited in claim 26, further comprising the steps of:

defining the displacement envelope through flexing of the radially unsupported pinion shaft.

38. A method The split torque gearbox as recited in claim 1, wherein said floating pinion axis of rotation, said first spur gear axis of rotation, and said second spur gear axis of rotation are generally parallel.

39. The split torque gearbox system as recited in claim 9, wherein said floating pinion axis of rotation, said first spur gear axis of rotation, and said second spur gear axis of rotation are generally parallel to a main rotor axis of rotation defined by said main rotor shaft.

40. The split torque gearbox system as recited in claim 6, wherein said first double helical gear is of a smaller diameter than said first spur gear and second double helical gear is of a smaller diameter than said second spur gear.

41. The split torque gearbox system as recited in claim 1, further comprising:

a face gear driven about a face gear axis of rotation, said radially unsupported pinion shaft mounted to said face gear;

a first gear driven by said first spur gear, said first gear defined along said first spur gear axis of rotation;

a second gear driven by said second spur gear, said second gear defined along said second spur gear axis of rotation;

an output gear meshed with said first gear and second gear; and

a first spur gear periphery of said first spur gear and a second spur gear periphery of said second spur gear at least partially overlaps an output gear periphery of said output gear adjacent a first side of said output gear, and a face gear periphery of said face

gear at least partially overlaps said output gear periphery adjacent a second side of said output gear.

42. The split torque gearbox system as recited in claim 41, further comprising:

an input shaft meshingly engaged with said face gear to define a gear mesh generally transverse to the floating pinion axis of rotation, said input shaft non-perpendicular to the floating pinion axis of rotation.

43. The split torque gearbox system as recited in claim 41,wherein said first gear includes a first double helical gear and said second gear includes a second double helical gear.

44. The split torque gearbox system as recited in claim 41, further comprising a main rotor shaft driven by said output gear.

45. The split torque gearbox system as recited in claim 8, wherein a first spur gear periphery of said first spur gear and a second spur gear periphery of said second spur gear at least partially overlaps an output gear periphery of said output gear adjacent a first side of said output gear, and a face gear periphery of said face gear at least partially overlaps said output gear periphery adjacent a second side of said output gear.

RELATED PROCEEDINGS APPENDIX

There are no related proceedings.

EVIDENCE APPENDIX

None.